

**WHAT IS BEING CLAIMED IS:**

1. A system for robotic manipulation of a plurality of objects,  
comprising:

a container for receiving the objects therein;

5 a liquid layer disposed in said container, the objects being  
disposed on a surface thereof;

means for applying energy to said liquid to establish  
oscillatory motion thereof sufficient to form a plurality of repeating vertically  
directed standing waves; and,

10 signal means coupled to said energy application means for  
supplying said energy with predetermined waveforms to dynamically position  
said standing waves in a predetermined pattern, said predetermined pattern of  
said standing waves dynamically arranging the objects in a predetermined  
configuration on said surface of said liquid.

2. The system as recited in Claim 1 where said energy application means includes means for vibrating a wall of said container.

5 3. The system as recited in Claim 1 where said energy application means includes a piezoelectric actuator mechanically coupled to said liquid.

10 4. The system as recited in Claim 1 where said liquid layer is formed by a nematic liquid crystal medium and said energy application means includes means for establishing oscillatory electric fields in said container.

15 5. The system as recited in Claim 1 where said liquid layer is formed by a ferrofluid and said energy application means includes means for establishing oscillatory magnetic fields in said container.

6. The system as recited in Claim 1 where the objects are individual molecular-scale structures.

5           7. The system as recited in Claim 6 where said molecular-scale structures are molecular circuit elements and said predetermined configuration defines a plurality of substantially identical nanoscale circuits.

10           8. The system as recited in Claim 1 where the objects are mechanical structures and said predetermined configuration defines a plurality of substantially identical nanoscale machine assemblies.

9. A system for robotic manipulation of a plurality of objects,  
comprising:

a container for receiving the objects therein;

at least a pair of fluid layers disposed in said container, at

5 least one of said fluid layers being formed by a liquid, the objects being disposed  
adjacent an interface between said pair fluid layers;

means for applying energy to said liquid to establish  
oscillatory motion thereof sufficient to form a plurality of repeating vertically  
directed standing waves; and,

10 signal means coupled to said energy application means for  
supplying said energy with predetermined waveforms to dynamically position  
said standing waves in predetermined patterns, said predetermined patterns of  
said standing waves dynamically arranging the objects in a predetermined  
configuration on said surface of said liquid.

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10. The system as recited in Claim 9 where said energy application means includes means for vibrating a wall of said container.

5 11. The system as recited in Claim 9 where said energy application means includes a piezoelectric actuator mechanically coupled to said liquid.

10 12. The system as recited in Claim 9 where said liquid is a nematic liquid crystal medium and said energy application means includes means for establishing oscillatory electric fields in said container.

15 13. The system as recited in Claim 9 where the objects are electrically conductive and said predetermined configuration defines a plurality of substantially identical nanoscale circuit patterns.

14. The system as recited in Claim 9 where the objects are individual molecular-scale structures.

5            15. The system as recited in Claim 14 where said molecular-scale structures are molecular circuit elements and said predetermined configuration defines a plurality of substantially identical nanoscale circuits.

10           16. The method as recited in Claim 14 where said molecules are carbon nanotubes.

17. A method for robotic manipulation of a plurality of objects,  
comprising the steps of:

- a. providing a container;
- b. providing at least two fluid layers in said container, at  
5 least one of said fluid layers being formed by a liquid;
- c. adding said objects to be manipulated to said  
container, said objects being disposed adjacent an interface  
between said liquid layer and said other fluid layer adjacent to said  
liquid layer;
- 10 d. agitating said liquid with energy having a  
predetermined first waveform to generate a first standing wave  
pattern therewith, said standing wave pattern of liquid dynamically  
arranging said objects; and,
- 15 e. positioning a substrate in said container, said  
substrate being adapted for adhesion of said objects thereto.

18. The method as recited in Claim 17 where the step of agitating said liquid includes the step of vibrating a wall of said container.

5 19. The method as recited in Claim 17 where the step of includes the step of agitating said liquid includes the step of energizing a piezoelectric actuator mechanically coupled to said liquid.

10 20. The method as recited in Claim 17 where the step of providing at least two fluid layers includes the step of providing at least one nematic liquid crystal layer and said step of agitating said liquid crystal layer includes the step of establishing and applying oscillatory electric fields thereto.

15 21. The method as recited in Claim 20 where the step of establishing and applying oscillatory electric fields includes the step of generating predetermined waveforms for establishing said oscillatory electric fields and thereby dynamically arranging said objects in a predetermined pattern.



22. The method as recited in Claim 17 where the step of adding said objects includes the step of providing molecular-scale circuit elements as objects to be manipulated and the step of agitating includes the step of generating said predetermined first waveform to dynamically arrange said molecular circuit elements into a plurality of substantially identical nanoscale circuits.

23. The method as recited in Claim 17 where the step of adding said objects includes the step of providing nanometer-scale mechanical elements as objects to be manipulated and the step of agitating includes the step of generating said predetermined waveforms to dynamically arrange said mechanical elements into a plurality of substantially identical nanoscale machine assemblies.

24. The method as recited in Claim 17 where the step of positioning a substrate is followed by repeating the step of agitating said liquid, the liquid being agitated by energy having a predetermined second waveform to generate a second standing wave pattern therewith to thereby displace said objects on said substrate.